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HTHP Filter Press for Drilling Fluid Testing

with 175-mL, Single-Capped Test Cell and N_2 Pressuring Manifold

170-00-3 (115 V)
170-01-3 (220 V)

Instruction Manual

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Ver. 2.3

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Intro

The OFI Testing Equipment (OFITE) High Temperature High Pressure (HTHP) Filter Press is designed to evaluate the filtration characteristics of drilling fluids, cement slurries, fracturing fluids, and completion fluids under elevated temperatures and pressures. Evaluating fluids under HTHP conditions similar to the downhole environment is of paramount importance. Fluid properties must be monitored while under high temperatures and pressures as filtration behavior and wall cake building characteristics of permeable formations change with changing environments. These characteristics are affected by the shape, type, and quantities of solids present in the fluid and their physical and electro-chemical interactions, all of which are affected by changing temperatures and pressures.

OFITE manufactures and provides HTHP filtration units in two basic sizes, 175 mL and 500 mL capacities. Both are used extensively throughout the world and in all environments, but in general the 175 mL units are designed for field portability, while the larger 500 mL units are designed for laboratory usage at higher temperatures and pressures. All OFITE Filtration devices fully conform to American Petroleum Institute (API) specifications.

A complete HTHP Filter Press consists of a controlled pressure source, usually Nitrogen pressurization or Carbon Dioxide bulbs for the 175 mL units. Top and bottom pressure manifolds are provided to simulate the differential pressures found in a down-hole environment, and to prevent evaporation of the base fluid if exceeding the boiling point of that fluid. The test cells are provided in a variety of assemblies, depending upon the type of fluid tested, the filter media, and the temperatures and pressures desired. The test cells are encased inside a heating jacket, which is adjustable.

A variety of filter media are available, the most common being standard API filter paper, cement screens, and ceramic filters. The ceramic filters may be obtained to match the pore throat or permeability of the formation. Natural formation filters or cores may also be used of differing pore throat / permeability sizes. Slotted disks of varying sizes are frequently used for lost circulation materials studies.

Both the 175 mL and the 500 mL heating jackets are capable of reaching 400°F (204°C), but lower fluid volumes due to fluid expansion at higher temperatures, limit the 175 mL units to a useful working temperature of 300°F (149°C). Anyone running tests above 350°F (177°C) must substitute a complete set of o-rings after each and every test.

Specifications

Size:	7.5" × 11" × 23.5" (19.1 × 27.9 × 59.7 cm)
Weight:	27 lb. (12.3 kg)
Shipping Size:	17" × 23.5" × 12.5" (43.2 × 59.7 × 31.8 cm)
Shipping Weight:	38 lb. (17.2 kg)
Maximum Temperature:	400°F (204°C)
Maximum Pressure (Cell):	1,500 PSI (10,343 kPa)
Maximum Pressure (Receiver)	750 PSI (5,171 kPa)
Pressure Source:	Nitrogen Tank (Sold Separately)
Test Cell Capacity:	175 mL
Voltage:	115 VAC, 5 Amps, 50/60 Hz
	230 VAC, 3 Amps, 50/60 Hz
Heater:	400 Watt

Components

Supplies:

#153-14	Glass Graduated Cylinder; 50 mL × 1 mL
#154-10	Metal Dial Thermometer; 5" Stem; Dual Scale: 50° - 500°F / 0° -250°C
#170-19	Filter Paper, 2 ½" (6.35 cm), Specially Hardened for Filter Presses, 100/box
#170-35	Adjustable Wrench, 6 inch

#170-00-1 Heating Jacket (115V)
#170-01-1 Heating Jacket (230V):

#130-10-52	Jam Nut; ⅜"-24; Stainless Steel; Qty: 2
#164-32	Male Connector for Power Cable (For #170-01-1 230V ONLY)
#165-40-4	Power Cable, 230 Volt
#170-05	Thermostat
#170-09	Insulation Board
#170-10	Thermostat Pilot Light
#170-11	Heating Element; 115V; 200W; Qty: 2
#170-15	Base
#170-21	Stand Support Rod; Qty: 2
#170-25	Aluminum Well
#170-30	Stainless Steel Thermostat Cover
#170-44	Rubber Foot, ½"; Qty: 4
#171-32	Midget Knob
#171-82	Power Cord, 8', with Male Plug 8; 16/3 SJ; Round (For #170- 00-1 115V ONLY)

Assemblies:

#170-06-1 Back Pressure Receiver; 15 mL Stainless Steel Tube for N2

#144-11	Street Ell, 90, ⅛"
#144-15	Plate Brass Bushing; ⅛" NPT Male to ⅛" NPT Female
#170-07	O-ring
#170-28	Receiver Body
#170-32	NPT Male Needle Valve, ⅛" × ⅛"
#171-23-1	Safety Pin with Lanyard

#170-12-1 175-mL, Single-End Test Cell; 1500 PSI (10,342.5 kPa)

#170-12	Cell Body; 316 Stainless Steel, 500 PSI (1-0342 kPa)
#170-13-3	Cell O-ring; Viton 75; Qty: 2
#170-14	Cell Cap, 1,500 PSI (1-0342 kPa)
#170-16	Valve Stem; Qty: 2
#170-17	Valve Stem O-ring; Qty: 4
#170-26-1	Stainless Steel Locking Screw, Hardened; Qty: 6
#170-27	Allen Wrench, 5/32"
#170-19	Filter Paper 2½" (6.35 cm); Specially Hardened for Filter Presses
#170-35	Adjustable Wrench, 6 inch

#171-24 1350 / 750 PSI (9,308 / 5,171 kPa) Nitrogen Manifold

#170-20	Manifold Block
#170-32	NPT Male Needle Valve, ⅛" × ⅛"
#171-22	Retainer Pin
#171-24-001	Regulator, Modified; Qty: 2
#171-24-1	Chrome Nut; R.H.; Reg Inlet CGA-580
#171-24-2	Nipple with Filter
#171-24-3	Flare × ⅛" to FNPT Female, ¼"
#171-24-4	NPT Pipe Plug; 316 Stainless Steel, ¼"
#171-24-5	NPT Street Tee; 316 Stainless Steel, ¼"; Qty: 2
#171-25-1	Relief Valve set at 750 PSI (5171 kPa)
#171-25-2	Relief Valve set at 1350 PSI (9308 kPa)
#171-26	Hose, 5000#; 3/16" × 3'; Qty: 2
#171-28	Dual Manifold Body
#171-38	Gauge, 1,000 PSI; 2"; ¼" NPT Bottom
#171-40	Gauge, 1,500 PSI; 2"; ¼" NPT Bottom
#171-42	Gauge, 3,000 PSI; 2"; ¼" NPT Bottom
#171-90-06	⅛" MNPT × ⅛" FNPT Reducing Bushing; 316 Stainless Steel
#171-90-07	Hex Nipple, ¼" NPT; 316 Stainless Steel; Qty: 2
#171-90-13	Adapter, ¼" Flare × ¼" Male NPT

Optional:

#170-37	Nitrogen Cylinder; 21" × 7"; Right-hand Thread
#170-13-3	Test Cell O-ring; Viton
#170-00-3-SP	Spare Parts for 170-00-3
#143-00-1	Diaphragm for Airco Regulator; Qty: 2
#143-07	Repair Kit for Regulator (#143-00); Qty: 2
#153-14	Graduated Cylinder; 50 mL × 1 mL; Qty: 2
#154-10	Dual-Scale Thermometer with Dial; 5" Stem; 50° - 500°F (0° - 250°C)
#170-05	Thermostat; 50° - 500°F (10° - 260°C)
#170-07	O-Ring
#170-10	Thermostat Pilot Light
#170-11	Heating Element, 115V, 200W; Qty: 2
#170-13	Cell O-ring; Buna N; Qty: 50
#170-16	Valve Stem; Qty: 4
#170-17	Valve Stem O-ring; Qty: 100
#170-19	Filter Paper; 2" (6.35 cm); Specially Hardened for Filter Presses; Qty: 10
#170-26	Stainless Steel Locking Screw; Qty: 24
#170-27	Allen Wrench; 5/32"
#171-22	Retaining Pin; Qty: 2
#171-32	Midget Knob

Optional:
#170-00-3-SP Spare Parts Kit

Part Number	Description	Quantity
#143-00-1	Diaphragm for Concoa Regulator	2
#143-07	Repair Kit for Concoa Regulator	2
#153-14	Graduated Cylinder, 50 mL × 1 mL	2
#154-10	Dial Thermometer, 5" stem, 5-500°F & 0-250°C	1
#170-05	Thermostat	1
#170-07	O-Ring, Nitrile 70D	1
#170-10	Thermostat Pilot Light	1
#170-11	Heating Element 115 Volt – 200 W	2
#170-13-3	O-ring for test cell and cap, Viton 75D	50
#170-16	Valve Stem, for cell pressure and de-pressurization	4
#170-17	O-ring, for Valve Stem, Viton 75D	100
#170-19	Filter Paper, 2 ½" (6.35 cm), hardened for Filter Press, 100/box	10
#170-26-1	Locking Cap Screw, Hardened Alloy Steel	24
#170-27	Allen Wrench, 5/32"	1
#171-23-1	Safety Pin with Lanyard	2

Note

Spare parts listings are intended to be used as a reference for future purchases. Everyone's consumable requirements will be different, and replacement quantities needed will depend upon the number of test performed on a daily and/or weekly basis.

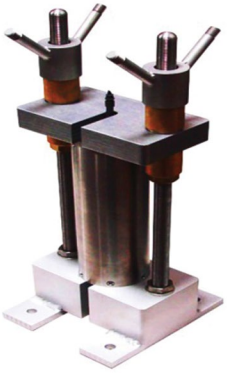
Optional Items for HTHP Filtration Testing:
The items listed below are not included in the HTHP Filter Press, but they are items that will enable the technician to perform a more uniform and reproducible test while maintaining a high degree of safety. As optional items, the usage is not compulsory, but consideration should be given to these items when running tests at elevated temperatures and pressures. Some of the items will be used only on cell assemblies using set screws as fasteners, while others should be implemented when operating all filtration equipment.

Interval Timer, 60 minute
(#155-20)

Cell Cap Removal Tool
(#170-33)
(Set Screw Cell Assemblies Only)

Cell Carrying Tool (#170-40)

HTHP Pressure Relief Tool
(#170-91)
(To release trapped pressure)

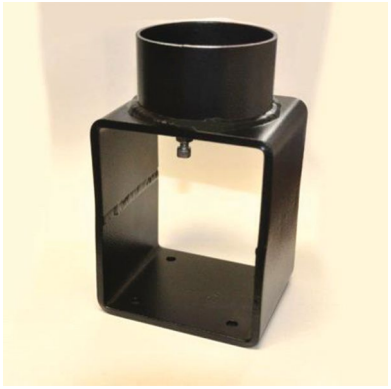


Safety Clamp (#170-92)
(Set Screw Cell Assemblies Only)

Safety Shield (#171-06)

High Pressure Nitrogen Assy.
(#171-31)

Thermocouple Assembly
(#171-45-1)
(Direct temperature measurement
Of the fluid Inside the Cell)



Stand for HTHP Cell Assembly
(#171-190-028)

Safety

Pressure and Temperature Considerations
Do not use or reconfigure this equipment in a manner not specified in this manual.

Pressure
There are two reasons for operating at elevated pressures when performing a filtration analysis.

1. To test fluids at temperatures above the boiling point, the vessel must be pressurized, which in turn elevates the vapor pressure (boiling point) so that the fluid remains liquid and does not turn to steam.
2. If testing for drilling applications, pressurization will more approximate down-hole conditions, enabling the technician to match both bottom hole temperatures and pressures.

For temperatures less than 200°F (93°C) a back pressure receiver is not required as the filtrate will not reach the boiling point. However when operating above the boiling point of water, a suitable back pressure receiver is required, otherwise the test fluid will turn to steam and the test is invalidated. The standard receiver tube supplied with the 175 mL HTHP Filter Press holds 15 mL of filtrate, so it is very important that the receiver outlet ball valve is opened after approximately ten seconds of filtrate collection, as a fluid with poor filtration qualities can easily fill the 15 mL receiver tube almost instantaneously. If this happens the filtrate hopefully will all be ejected from the safety bleeder valve, but if there is too much fluid volume, the liquid may end up inside the regulator rendering it useless which will require servicing by a knowledgeable technician.

Nitrogen is commonly used as a pressure source. A small Nitrogen cylinder (#170-37), size 21" × 7" (Optional) provides the pressure source. These cylinders are shipped empty, but when filled they may be pressurized to 2,216 PSI / 153 Bar. They have a standard CGA-580, Compressed Gas Association – left handed thread fitting connection. CGA 590 right handed thread fittings are available upon request. A dual Nitrogen manifold assembly is used and pressurizes both the top and the bottom or back pressure devices simultaneously or individually as needed.

Temperature
Normally when one experiences a loss of pressure it is not due to a failure of the metal alloy in the cell, but rather is a failure of the o-ring or elastomer, which provides the seal. These o-ring may deform or melt under elevated temperatures usually over 400°F (204°C) causing a pressurization failure of the cell, which is often sudden and catastrophic. For example, if the valve stem o-ring suddenly fails, then steam at 400°F and under great pressure may shoot outward horizontally in one or several directions. A safety shield should always be used when operating any HTHP Filter Press and especially when one is going to extreme temperatures and pressures. Above 350°F (176°C) all o-rings must be replaced after each and every test.

Heating Jacket

Turn the thermostat knob on the front of the metal plate to change the temperature of the heating jacket. The thermostat cover is marked from 1 to 10 and each whole number represents a separate temperature. Each filter press will heat up a little differently so it is a good idea to mark with a pen directly on the face-plate of the thermostat cover the temperature which corresponds with each number. The actual temperature of the heating jacket is measured with a stem thermometer and then the thermometer is placed into the cell body.

The heating jacket will get very hot during the test so be careful not to touch the outside of the jacket at any time during the heat-up period or the test. It is especially easy to get burned when installing or removing the back pressure receiver as the technician is working in a very confined space. The power cord is supplied for either 115 Volts or 230 Volts and due to the various types of plug connectors around the world it may be necessary to change the plug on the end of the power cord. The power cable is 8 feet in length and the heating jacket should be placed no farther than 8 feet from the appropriate electrical outlet. The heat up time will vary from one instrument to the next and the pilot light will turn on when the set temperature has been reached. The temperature of the fluid inside the cell however will not be at the set temperature, so always allow one hour of heating time for the fluid, after the cell has been fully inserted into the heating jacket.

The HTHP Filter Press is a very safe instrument to operate as long as the instructions are strictly followed. It is imperative that the technician thoroughly understands the assembly and disassembly procedures and also why the order of steps is in place. Care should be taken to never use defective parts and that OFITE's temperature, pressure, and fluid volume limits are strictly adhered to at all times.

The heating jacket and cell will get very hot during the normal duration of the test so the operator should take care to avoid burns. The operator should be careful when attaching and removing pressure manifolds from the heating jacket, especially the back pressure receiver assembly, which involves operating in a small confined space.

Safety Retainer Pin

Always use a Safety Retainer Pin with an attached lanyard, and get in the habit of securing the cotter pin to the pin. Improper placement of retainer pins in the past have resulted in the pressure manifold separating from the filter press which can cause damage to the equipment.

Retainer Pin with Lanyard

171-23-1 Safety Retainer Pin with Lanyard

The 175 mL HTHP Filter Press (#170-00-3 and #170-01-3) uses Nitrogen as the pressure source for both the inlet and the back pressure. Nitrogen is more inert or less chemically reactive than Carbon Dioxide and therefore it is used extensively in filtration control analysis where chemical reactions tend to occur when subjected to elevated temperatures and pressures. A dual Nitrogen manifold is supplied which regulates pressure to both the inlet and outlet ends of the pressure cell. A single Nitrogen regulator is available if dual pressurization is not required. Nitrous Oxide (NO_2) is available in the same sized bulbs as CO_2, but should never be used as a pressure source for HTHP Filtration. Under high temperatures and pressures, Nitrous Oxide can detonate in the presence of grease, oil or carbonaceous material.

Nitrogen Bottle (#170-37) Optional

High Pressure Nitrogen Cylinder (#171-31) Optional

Working Pressure

OFITE clearly stamps the working pressure of the cell assembly along with the assembly serial number on each cell body and cell cap. These pressure limits should never be exceeded on the pressure manifolds and fluid volumes inside the cell should strictly comply with instructions (see page 13). However, in the past HTHP cells and caps from various manufacturers were often not stamped, or in some cases, very old cell assemblies were stamped "2500". Cell assemblies with set screw secured caps should never be taken to 2,500 PSI, under any temperature or condition.

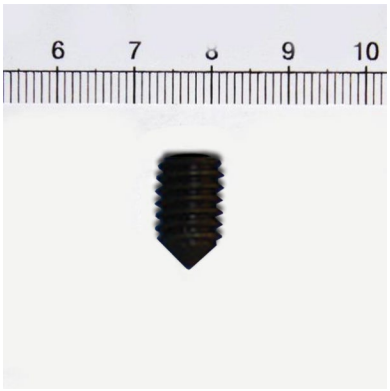
Important

The 175 mL HTHP Filter Press (#170-00 and #170-01) are furnished with a standard 1,500 PSI working pressure cell assembly. OFITE also manufactures HTHP cells with a 2,000 PSI working pressure. Please note the 1,500 PSI and 2,000 PSI cell assemblies do not have parts that are interchangeable, so when ordering replacement cell caps for instance, know which working pressure rated cell assembly you are ordering for.

Cell Cap, 1,500 PSI, Set Screws: 0.75 inch thick
Cell Cap, 2,000 PSI, Set Screws: 0.94 inch thick

Locking Set Screws

Locking set screws should have sharp points on the end. If the tip becomes worn and flattened, pressure may be lost in the cell or the cell cap may become damaged. Any set screw cell cap that has elongated set screw holes should be discarded as they are unsafe.



Locking Screw for HTHP Cell Caps 2,000 PSI, 90 Cone Point (#170-26-1)

Cell Cap, 1,500 PSI, HTHP Filter Press 60 mesh screen. 2.5" × 0.75" Note - Round Set Screw Holes. (#170-14)

O-ring Seals

The choice of o-rings, or elastomers as they are commonly called, is very important in any high temperature high pressure environment. OFITE uses Viton o-rings, a copolymer of Vinylidene, which are less pliable than some Buna rings which may be encountered from other manufacturers, but they withstand the higher temperatures better than the Buna rings. The maximum temperature for the Viton o-rings is 400°F (204°C). OFITE suggests that all o-rings (cell caps, cell bodies, and valve stem) are changed each time after running a test of 350° F (176° C) or above.

Fluid Expansion Space

Cells should never be filled completely with fluid. Always leave some room for the fluid to expand under temperature. This keeps the cell caps from becoming overstressed and possibly leading to a cell pressure failure or even a loss of the cell cap completely.

Periodically check all gauges to ensure the proper pressures are in the cell, as the pressure often increases or decreases depending upon the test procedure and conditions.

API Recommended Void Space		
Fluid / Temperature	**Void Space**	**Fluid Volume**
Water-based drilling fluid. < 300°F	0.6" (1.5 cm)	138 mL
Water-based drilling fluid. > 300°F	1.5" (4.0 cm)	86 mL
Oil-based drilling fluid. < 350°F (176°C)	1" (2.5 cm)	115 mL
Oil-based drilling fluid. > 350°F (176°C)	Not Recommended- Use 500 mL Cell	

Void Space in a 1,500 PSI rated cell body

The 175 mL HTHP Filter Press uses two regulators as standard equipment. Both may be operated with Carbon Dioxide (CO_2) or Nitrogen (N_2) gas.

1. Concoa Regulator 8051140-00-1: Top or Main Pressure.
   a. Maximum Inlet Pressure – 3,000 PSI
   b. ¼ inch NPT Connections
   c. Single stage regulator

Regulator Safety

1. Never subject the regulator to inlet pressure greater than its rated inlet pressure as shown on the regulator body.

2. Do not allow oil, oil bearing materials, grease, or other combustibles to contaminate the inside or outside of the regulator, especially where Oxygen is in use.

3. To minimize heat effects, avoid the use of piping or tubing between the pressurized cylinder and the regulator. If unavoidable it should be as short as practical and equipped with a shutoff valve located just before the regulator.

4. The 8051140 regulator has been internally cleaned for Oxygen but it is not recommended to pressurize HTHP Filtration tests with Oxygen due to its potentially explosive nature.

5. Never pressurize a regulator that has loose or damaged parts or is in questionable condition. Never loosen a connection or attempt to remove a part until gas pressure has been relieved.

6. Before transporting pressurized cylinders that are not secured on a cart designed for such transport, remove all regulators and recap the cylinders.

7. Check the regulator and all connections for leaks after installation and periodically thereafter. Also check for leaks after any service in which parts or connections were loosened. Brush with an approved leak detection solution and bubbles should indicate a leakage.

8. An appropriately sized pressure relief device downstream of the regulator should be installed in your system to prevent damage to equipment and/or injury to personnel should an internal failure of the regulator occur.

9. Do not purge oxidizing or flammable gases in the presence of flame, lit cigarettes, or other sources of ignition or towards people.

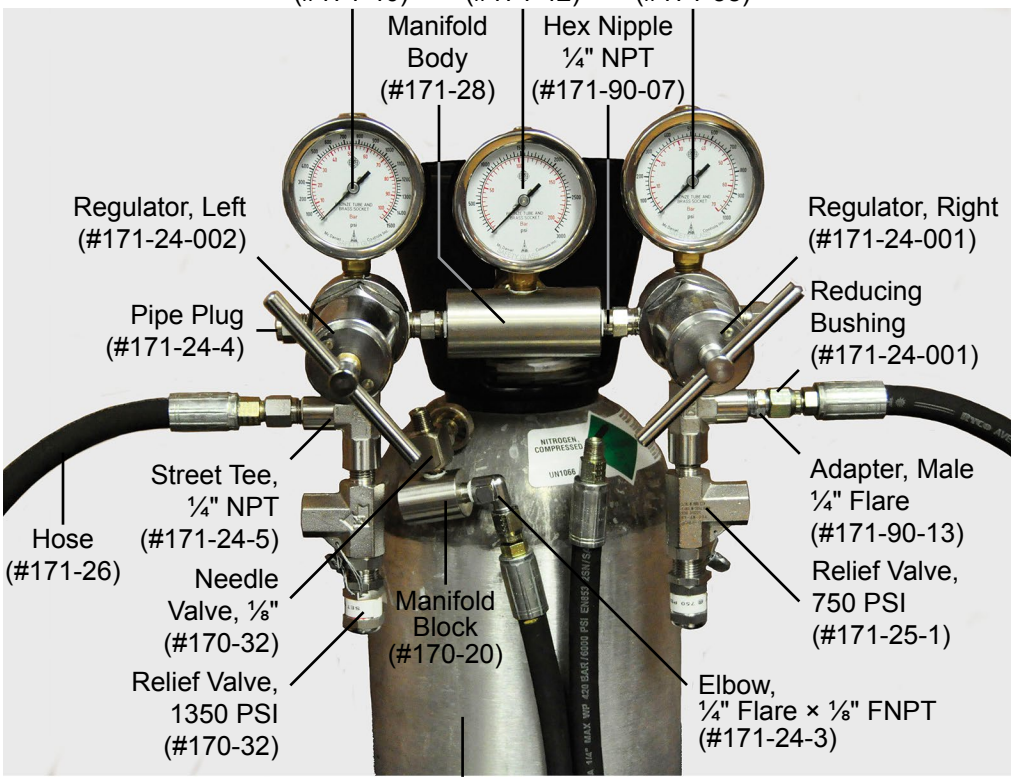
HTHP Cell Assembly

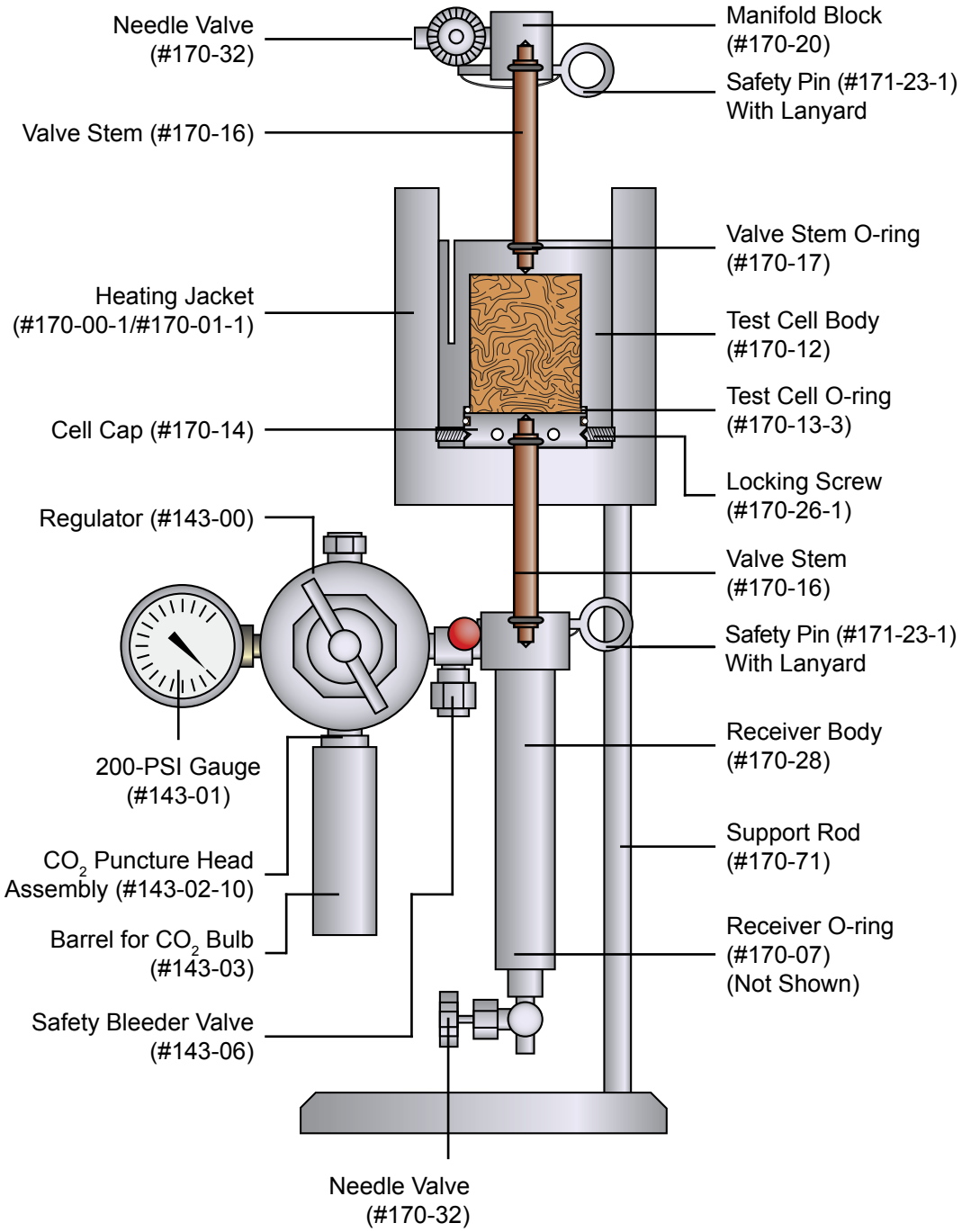
The 170-12-1 HTHP cell assembly can handle maximum standard filtration tests at elevated temperatures and pressures. The maximum pressure rating is 1,500 PSI and the temperature is 400°F (204°C). Most tests, conducted with the 175 mL capacity filter presses under API standards, operate at an inlet pressure of 600 PSI and with temperatures up to 350°F (176°C). The cell bodies and cell caps are scribed with serial numbers so that the same cap and same cell bodies are used on each and every test, resulting in more reproducible results. Additional information includes the part number, temperature rating, the alloy and pressure rating of the cell.

All OFITE HTHP cell assemblies are made of Stainless Steel. For very corrosive environments cell assemblies made of Hastelloy™ C-276 or Inconel are available and recommended.

Diagrams

Dual Nitrogen Manifold (#171-24)




Needle Valve
(#170-32)
Manifold Block
(#170-20)
Safety Pin (#171-23-1)
With Lanyard
Valve Stem (#170-16)
Valve Stem O-ring
(#170-17)
Heating Jacket
(#170-00-1/#170-01-1)
Test Cell Body
(#170-12)
Test Cell O-ring
(#170-13-3)
Cell Cap (#170-14)
Locking Screw
(#170-26-1)
Regulator (#143-00)
Valve Stem
(#170-16)
Safety Pin (#171-23-1)
With Lanyard
Receiver Body
(#170-28)
200-PSI Gauge
(#143-01)
Support Rod
(#170-71)
CO_2 Puncture Head
Assembly (#143-02-10)
Barrel for CO_2 Bulb
(#143-03)
Receiver O-ring
(#170-07)
(Not Shown)
Safety Bleeder Valve
(#143-06)
Needle Valve
(#170-32)

Quick Start

1. Pre-heat the heating jacket to 10°F (6°C) above the desired test temperature.
2. Place a thermometer into the heating jacket.
3. Check all o-rings and coat with a thin coat of silicone grease.
4. Install o-rings in the cell, cell cap and valve stems.
5. Stir the test sample for ten (10) minutes with a high speed blender.
6. Install and tighten completely with a wrench the inlet valve stem.
7. Invert the cell and fill with test fluid being careful not to get fluid on the cell o-ring. Leave room for fluid expansion.
8. Place a circle of filter paper on top of the cell o-ring.
9. Inspect the cap locking screws and the cell cap seats.
10. Align the arrows on the cell cap and cell body and place the cell cap into the cell.
11. Tighten the set screws into the cell, initially alternating screws.
12. With the fingers check that all of the set screws are completely tightened.
13. Screw the valve stem into the cap and tighten completely with a wrench.
14. Lower the cell into the heating jacket and rotate so it “seats” into the heating jacket.
15. Move the thermometer from the heating jacket to the test cell.
16. Set a timer to 60 minutes and begin heating the sample for exactly one hour (Never heat for more than 1 hour).
17. Connect the manifold block to the inlet valve stem and lock it in place with the retaining pin and lanyard.
18. Check the needle valve on the manifold block is closed (tightened clockwise).
19. Connect the male end of the pressure hose to the back pressure receiver.
20. Connect the back pressure receiver to the outlet valve stem. Lock it in place with the retaining pin and lanyard.
21. Check the needle valve on the outlet end of the receiver is closed (tightened clockwise).

22. Adjust both the top and back pressure on the dual manifold to the recommended back pressure PSI.

23. Open (loosen) the inlet valve stem ½ turn to pressurize the sample to prevent evaporation.

24. After heating for 60 minutes, increase the inlet pressure to 500 PSI (3,448 kPa) greater than the back pressure.

25. Open (loosen) the outlet valve stem ½ turn to initiate filtration.

26. Set a timer for 7.7 minutes and a second timer for 30 minutes.

27. Monitor both the inlet and outlet pressure gauges for a pressure build up or loss.

28. Collect filtrate by opening the needle valve (turning counter clockwise), but only until there is a pressure drop.

29. Initially collect filtrate after about ten seconds. This ensures there is good filtration control.

30. Collect filtrate after 1 minute and record the volume.

31. Collect filtrate after 7.5 minutes and record this amount (including the filtrate collected previously).

32. Maintain the temperature to ± 5°F (±3°C) during filtration collection.

33. After 30 minutes, the test is over. Immediately close (tighten) both the inlet & outlet valve stems on the cell.

34. Allow a minimum of 5 minutes for the filtrate to cool and collect filtrate by opening the receiver needle valve.

35. Close the receiver needle valve.

36. Immediately close (tighten) both the inlet and outlet valve stems on the cell.

37. Loosen the dual manifold t-screws on both the inlet and outlet regulators.

38. Release the top pressure from the regulator by opening (loosening) the needle valve on the inlet manifold block.

39. Release the bottom pressure from the regulator by opening the receiver needle valve and collect any remaining filtrate.

40. Remove the top inlet manifold block by releasing the retainer pin and lanyard.

41. Remove the back pressure receiver assembly by releasing the retainer pin and lanyard.

42. Carefully drain any residual filtrate into the graduate cylinder.

43. Record the amount of filtrate collected in the graduate cylinder by multiplying the amount in milliliters by 2.

44. Carefully remove the cell from the heating jacket.

45. Cool the cell for one hour at room temperature or for 10 minutes in cool water. It should be below 100°F (38°C).

46. Place the cell upright with the inlet side up.

47. Open (loosen) the inlet valve stem. There should be a noticeable release of pressure.

48. Loosen the set screws. Do this with the cell positioned downward as much as possible, or horizontal.

49. Remove the cell cap from the cell body.

50. Separate the filter cake from the filter media.

51. Gently wash the liquid from the filter cake.

52. Measure and record the thickness of the filter cake to the nearest 1/32 inch or millimeter.

53. Report the description of the filter cake: thin, hard, rubbery, etc.

54. Thoroughly clean all equipment and replace o-rings if the test was conducted above 300°F (150°C).

Operation

1. Plug the heating jacket into an appropriate power source. Place a dial type metal thermometer into the heating well and preheat to 10°F (6°C) above the desired test temperature. A pilot light will come on when the heating jacket reaches the temperature set by the control knob.

2. Be sure all of the o-rings are in good working condition (pliable with no nicks or cuts, etc.), and are not damaged during the assembly procedures. Carefully install an o-ring (#170-13-3) in the o-ring groove in the cell body and another o-ring (#170-13-3) in the cell cap (Note: They are the same o-ring). Place a thin film of silicone grease on all o-rings.

Important

When testing above 300°F (150°C) it is recommended to replace the o-rings after every test.

HTHP Filter Press Cell Assembly, 1500 PSI,
175 mL, (#170-12-1)

3. Prepare the sample according to API specifications. Stir the test sample for 10 minutes with a high speed mixer.

4. Place two o-rings in the o-ring grooves on each valve stem. Screw one valve stem into the test cell on the inlet side of the cell. Tighten the valve stem completely. To increase the life of the valve stem and cap, apply a thin layer of high-temperature thread lubricant (#165-44-1) to the o-ring on the bottom of the valve stem.

5. Invert the cell body and carefully pour the sample into the cell, leaving the appropriate amount of void space as indicated by the chart on page 22. Be careful not to spill fluid on the o-ring inside the cell.

Temperature – Pressure – Volume: Recommendations
Be Careful Not to spill fluid on the O-ring Groove inside the Cell

API Recommended Void Space		
Fluid / Temperature	**Void Space**	**Fluid Volume**
Water-based drilling fluid. < 300°F	0.6" (1.5 cm)	138 mL
Water-based drilling fluid. > 300°F	1.5" (4.0 cm)	86 mL
Oil-based drilling fluid. < 350°F (176°C)	1" (2.5 cm)	115 mL
Oil-based drilling fluid. > 350°F (176°C)	Not Recommended- Use 500 mL Cell	

Void Space in a 1,500 PSI rated cell body

6. Place an o-ring in the cell and another on the outlet cell cap (They are the same sized o-ring). To facilitate removing the cell cap at the end of the test, lightly apply a coat of stopcock grease (#153-55) to the cell cap o-ring.

7. Inspect the cap locking screws. If the cap locking screws are no longer pointed, there is a possibility of stress failure and the screw(s) should be replaced.

8. Inspect the cap locking screw seats in the cell cap (indents in the cell cap). If the cap locking screw seats are no longer round, there is a possibility of stress failure and the cap should be replaced.

9. Place a circle of filter paper on top of the cell o-ring and gently push the paper downward so it contacts the o-ring without the paper binding or pinching.

10. Make sure the arrow on the cell cap lines up with the arrow on the cell body and slowly push the cell cap into the cell. Ensure that the o-ring does not slip out of the o-ring groove during insertion of the cell cap. Not attaching or tightening the valve stem on the cap makes this operation easier.

11. Use the Allen wrench to tighten the six locking set screws into the cell and secure the cell cap in place. Use hand-touch make sure that all of the set screws are completely tightened. The cell may become permanently stuck inside the heating jacket if one or more set screws are left protruding from the cell.

12. Install the valve stem into the cell cap. Use a wrench to tighten it completely.

13. Invert the cell and, holding the valve stem, place the cell in the heating jacket with the outlet (filter) side of the cell pointed down. Rotate the cell inside the heating jacket so that the pin in the bottom of the heating well seats into the hole in the bottom of the test cell. This will anchor the cell in the well and prevent it from rotating as the valve stems are opened and closed. Check the inlet and outlet valve stems with a wrench to ensure they are tight.

14. Move the thermometer from the heating jacket to the thermocouple hole on top of the test cell. The heating time of the sample should be one hour (no more and no less). Set a timer to 60 minutes. Begin the heating at this time.

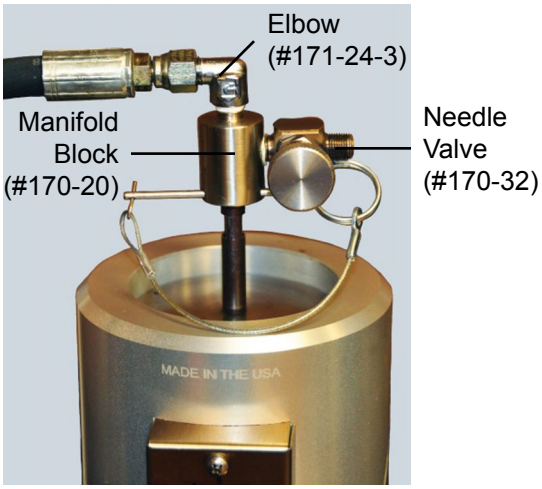
Note

Do not initiate filtration when the thermometer indicates the desired temperature has been reached. The fluid inside the cell may not have yet reached the proper temperature. An API funded project found that for most fluids, it usually takes upwards of an hour for the fluid inside the cell to reach the target temperature. If accurate temperature measurement is required during the heating portion of the test, a Thermocouple Assembly (#171-45-1) is available which will directly and accurately measure the fluid temperature inside the cell.

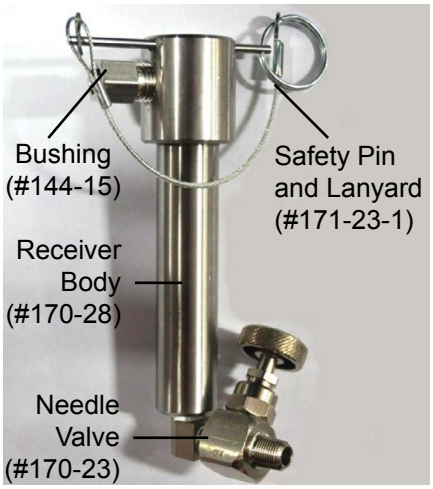
15. Connect the manifold block to the inlet valve stem and lock it in place with the retaining pin and lanyard. Check that the safety bleeder valve is closed (knob tightened clockwise).

16. Connect the male end of the pressure hose to the back pressure receiver. Make sure the receiver needle valve is closed.

17. Place the back pressure receiver on the bottom valve stem and lock it in place with the retaining pin and lanyard.



Top Pressurization Manifold Assembly



Bottom of Heating Jacket

18. Keeping the valve stems closed, adjust the top and bottom regulators on the manifold to the recommended back pressure for your test.

    The upper and lower limits of the test pressure differential are determined by the test temperature. If the test is conducted at a temperature less than the boiling point of water, then no back pressure will be required and filtrate may be collected directly into a graduated cylinder. If however tests are conducted above the boiling point of water, then as this temperature exceeds 212°F (100°C), the back pressure must be increased above the vapor pressure, at the test temperature, in order to prevent vaporization of the filtrate. If running a standard API test, the 500 PSI differential pressure must be maintained, so the top pressure will have to be increased 500 PSI over whatever the back pressure is. The table below shows the back pressures recommended for various test temperatures.

Recommended Minimum Back Pressure					
Test Temperature		Vapor Pressure		Minimum Back Pressure	
°F	°C	PSI	kPa	PSI	kPa
212	100	14.7	101	100	690
250	121	30	207	100	690
300	149	67	462	100	690
350	177	135	932	160	1,104
400	204	247	1,704	275	1,898

19. Open (loosen) the Inlet valve stem ½ turn to pressurize the sample. Maintain this pressure on the fluid until the temperature has stabilized. This will prevent vaporization of the test solution if heating above the boiling point of the liquid.

20. After the one hour heat up time, increase the pressure on the inlet pressure unit to 500 PSI (3,448 kPa) more than the back pressure.

21. Open (loosen) the bottom valve stem ½ turn to initiate filtration as soon as possible. Start the filtration test at this time. Set a timer to 30 minutes. If spurt loss is being measured, set a second timer to 7.5 minutes.

    Closely monitor the pressure gauges. If at any time during the test the pressure inside the cell rises above the setpoint, carefully open the needle valve on the top pressure assembly just enough to bleed off the excess pressure. Then close the valve. If the cell pressure decreases due to collection of filtrate, increase the pressure with the inlet regulator.

22. To collect filtrate, carefully open the needle valve on the bottom of the back pressure receiver while holding a graduated cylinder to the valve port. Close the valve immediately after the outlet pressure just begins to decrease and filtrate is collected.

    Collect filtrate at 10 seconds, 1 minute, 7.5 minute, and 30 minute intervals. The initial 10 second collection is precautionary in nature, as a fluid with little filtration properties may fill up the 15 mL receiver tube almost immediately, potentially damaging the regulator. Do not record the 10 second volume collected, but do record the volume collected at the other time intervals. Timers pre-set to 7.5 minutes and 30 minutes are helpful.

    While collecting filtrate, maintain the test temperature within ± 5°F (±3°C). If the back pressure rises during the test, cautiously reduce the pressure by opening the needle valve on the receiver and drawing off some of the filtrate into the graduated cylinder.

23. After 30 minutes the test is over. Immediately close (tighten) the top and bottom valve stems to seal off the cell.

24. Allow a minimum of 5 minutes for the filtrate in the receiver to cool to avoid vaporizing. Collect filtrate by opening the needle valve on the receiver and leave it open until fluid ceases to evacuate the valve.

25. Close (Tighten) the needle valve on the receiver.

26. Turn the regulator T-screws on both the inlet and back pressure receiver counterclockwise until the T-screw feels “loose”. This will close off the flow of pressurized gas.

27. Release the pressure from the Inlet pressuring unit to the cell by opening the needle valve (turn counterclockwise).

28. Open the outlet valve on the back pressure receiver to release pressure and collect Any remaining filtrate.

29. Remove the top Retaining Pin and Lanyard and remove the Manifold Block from the Valve Stem.

30. Remove the Back Pressure Assembly by releasing the Retainer Pin and Lanyard.

Important

Take care to avoid touching the hot heating jacket, especially when removing the back pressure receiver.

31. Drain any residual filtrate collected in the receiver into the graduated cylinder.

32. Record the total amount of filtrate collected in the graduate cylinder by reading from the bottom of the meniscus curve. Multiply this amount in milliliters by 2.

33. Remove the cell from the heating jacket after once again checking that the valve stems are tightly closed. An optional Cell Carrying Tool (#170-40) makes this a simple and safe operation.

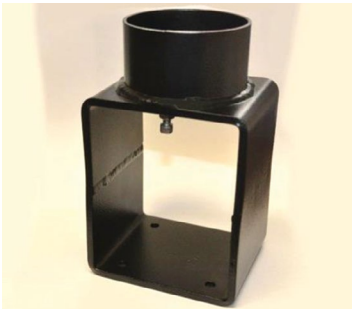
Important

DO NOT remove the heated cell using pliers or an open ended wrench attached to the valve stem. This is very dangerous and could cause serious damage.

Important

The test cell will still be under approximately 600 PSI (4.140 kPa) pressure. To avoid possible serious injury, position the cell with the outlet end down and cool it to room temperature before disassembling. The cell must be below 100°F (38°C). Cool for at least one hour at room temperature before loosening the cap locking screws.

34. Place the cooled cell upright with the outlet side down. The optional stand for the HTHP cell assembly (#171-190-028) makes a great cell holder. This will help preserve the filter cake. Open (loosen) the Inlet valve stem to bleed off pressure from the cell body. There should be a noticeable release of pressure from the cell.



Stand for HTHP Cell Assembly
(#171-190-028)

Hold a rag or piece of paper over the valve stem in order to catch any liquid or solids that might be ejected under pressure from the cell. This will help prevent an unsightly residue build up on the ceiling which may occur over time. It may be necessary to return the cell to the heating jacket and use the stop-pin in order to loosen the valve stem.

Note

Pressure should NOT be relieved from the cell by opening the outlet valve stem as the filter cake may seal off the cell.

Safe Release of Pressure from a Cell

Important

A good indication that pressure is trapped inside the cell body occurs if the set screws are unusually difficult to loosen (especially the 4th, 5th, and 6th ones) and the cell cap begins to extrude out of the cell body as the set screws are progressively loosened. To relieve any trapped pressure, an OFITE Pressure Relief Tool (#170-91) may be inserted through the inlet cell cap hole which will relieve any trapped pressure inside the cell. Ensure this function is performed on the inlet side of the cell as the filter cake may seal off the outlet end of the cell.

35. Loosen, but do not remove, the six cap locking screws, and separate the cap from the cell with a slight rocking motion. The OFITE Cell Cap Removal Tool (#170-33) makes it easy to remove tight, difficult to remove, cell caps which may have slightly heat expanded.

36. There are several ways to remove the filter along with the filter cake.

    a. Hold the cell and invert it over a sink and let the weight of the fluid inside the cell push the disk out.

    b. Careful manipulation with a spatula will often remove a filter and filter cake intact without losing fluid.

37. Discard the fluid inside the cell unless it is required for further testing. Save the filter cake for analysis.

38. Clean and dry the apparatus thoroughly after each use.

39. Inspect all o-rings for deformities and replace as necessary. Replace all o-rings if the test was conducted above 350°F.

Tip

After each test, the HTHP filter press should be left so that a new test may be performed with no clean-up and a minimum of assembly.

Data

Filtrate Volume

The HTHP filter press has a filtration area of 3.55 in^2 (22.9 cm^2). This is half the area of a standard filtration test, which is 7.1 in^2 (45.8 cm^2). To compare the results of this test to a standard filtration test, double the total filtrate volume collected for the full 30 minutes.

$$V_S = 2\ (V_{30})$$

Spurt Loss (Optional)

Spurt Loss is the amount of filtrate collected before the filter cake has had a chance to form and is expressed in millimeters. To calculate the spurt loss, use the following equation:

$$V_1 = 2\ [V_{7.5} - (V_{30} - V_{7.5})] = 2\ (2V_{7.5} - V_{30}) = 4V_{7.5} - 2V_{30}$$

Where:

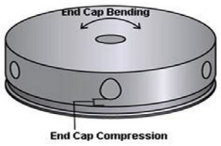
V_s = Standard Filtrate Volume (mL)
V_1 = Spurt Loss
$V_{7.5}$ = Filtrate volume collected after 7.5 minutes (doubled)
V_{30} = Filtrate volume collected after 30 minutes (doubled)

Filter Cake

Wash the filter cake on the paper with a gentle stream of water. Measure and report the thickness of the filter cake to the nearest 1/32" (0.8 mm). A ruler with the “zero mark” at the very edge of the ruler is useful here. Cake descriptions may be subjective and such notations such as hard, soft, rubbery, and fine, etc. convey adequate information on cake quality.

Maintenance

1. HTHP cell assemblies should periodically be checked for:



   a. Cell Corrosion – Stress cracking or pitting

   b. Cylinder Shear – Raised areas above the cell set screw holes

   c. Elongated set screw holes in the cell bodies

   d. End Cap Compression – Elongated set screw depressions on cell caps

   e. Set screws which are no longer tapered on the inside

   f. Elastomers – Check for flat spotting and melting

   g. Valve stems should be sharply pointed and not dull on outlet side.

2. Always thoroughly clean up after each tests.

   a. Replace all elastomers if previous test was in excess of 300°F (149°C).

   b. Clean out and blow dry if possible, the back pressure receiver.

   c. Cell body must be completely cleaned with special attention to the o-ring groove.

3. Periodically check for leaks.

   a. Cell Assembly – Immerse sealed pressurized cell assembly in a sink filled with water – look for bubbles.

   b. Top Pressure Assembly – Immerse regulator, valves, and sealed cell assembly in a sink full of water and look for bubbles. Hold assembly by the gauge and do not let the gauge get wet.

   c. Back Pressure Receiver – Similar to “B”. Hold assembly by the gauge and do not allow it to get wet.

Power Cord Maintenance

a. Check power cord for Insulation wear and loose connections near the heating jacket and plug.

b. The heating jacket should be placed no farther than the distance of the power cord from an electrical outlet.

c. The Power Cord should be kept away from the hot surface of the heating jacket, while in use.

Note

Any customer installed wiring, power cords or electrical connectors will Void All Warranties.

Storage Space

a. Consumables and tools should all be kept in one dedicated place.

b. Components such as manifold assemblies should be kept in a similar dedicated place.

4. Regulator and Manifold Maintenance

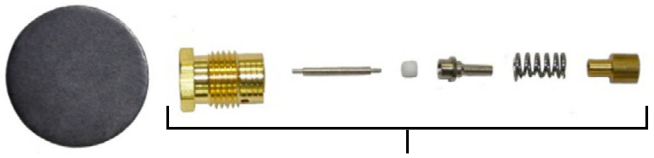
a. If the regulator loses pressure or steadily increases in pressure, replace the seat assembly and diaphragm.

Concoa Repair Kit – Part #143-07. Normally the Concoa regulator is supplied with the 175 mL models

Note

The large high pressure Concoa Regulator (805-1140) and the smaller Concoa Regulator (805-1179) both take the same Regulator Repair Kit

Always replace (order separately) the rubber diaphragm, #143-00-1, which is not supplied with the #143-07 kit.



Diaphragm (#143-00-1)

Repair Kit (#143-00-1)

To replace the Seat Assembly:

1. Unscrew the spring case (housing cover). This may require a strap wrench.
2. Remove the spring case.
3. Remove the rubber diaphragm (#143-00-1) from inside the spring case.
4. Remove the thrust plate (#143-00-7).
5. Using a wrench, loosen and remove the brass colored retainer.
6. The thrust pin and seat are now exposed and can be removed from the base.
7. Replace the spring – repair kit.
8. Replace the seat holder – repair kit.
9. Replace the thrust pin and the Teflon seat which can be attached before insertion-repair kit.
10. Replace the brass retainer and tighten with a wrench.
11. Replace the thrust plate with the curved edges downward.
12. Place a new rubber diaphragm inside the Soring case
13. Replace the spring case and hand tighten.

Regulator Maintenance and Trouble Shooting

Symptoms	Cause: Resolution
Gas leak at the regulator outlet when the adjusting screw is loosened fully counterclockwise	Seat leak or *creep: Repair the regulator
Outlet pressure increases while downstream valves are closed	Seat leak or *creep: Repair the regulator
Gas leak from the spring housing case	Diaphragm failure: Repair the regulator
Excess drop in outlet pressure with the regulator flow open	Blocked seat assembly or inlet filter: Repair the regulator
Gas leak from any pipe thread joint	Loose fitting: Remove the connection. Clean the affected surfaces. Reapply Teflon tape and tighten.
Gas leak from relief valve	Faulty relief valve: replace the valve. Seat leak or *creep: Repair the regulator
Inconsistent repeat readings	Seat sticking: Repair the regulator. Bad pressure gauge: Replace the gauge.
Gauge does not return to zero with no pressure applied to the regulator.	Gauge has physical damage: Replace the gauge.

*Creep is an increase in outlet pressure that occurs when pressure escapes even when the valve is closed. Regulator seats can be compromised by particles in the process stream which can cause minor imperfections in the sealing surface. The high flow and small orifice created during pressure regulation combine to turn a very small particle into a fast projectile. This projectile can nick the sealing surface of the seat and cause leaks. Filtering particulates from the process stream should be a high priority, and a small filter can reduce the potential for creep and increase the life expectancy and accuracy of the regulator.

Warranty and Return Policy

Warranty:

OFI Testing Equipment, Inc. (OFITE) warrants that the products shall be free from liens and defects in title, and shall conform in all respects to the terms of the sales order and the specifications applicable to the products. All products shall be furnished subject to OFITE's standard manufacturing variations and practices. Unless the warranty period is otherwise extended in writing, the following warranty shall apply: if, at any time prior to twelve (12) months from the date of invoice, the products, or any part thereof, do not conform to these warranties or to the specifications applicable thereto, and OFITE is so notified in writing upon discovery, OFITE shall promptly repair or replace the defective products. Notwithstanding the foregoing, OFITE's warranty obligations shall not extend to any use by the buyer of the products in conditions more severe than OFITE's recommendations, nor to any defects which were visually observable by the buyer but which are not promptly brought to OFITE's attention.

In the event that the buyer has purchased installation and commissioning services on applicable products, the above warranty shall extend for an additional period of twelve (12) months from the date of the original warranty expiration for such products.

In the event that OFITE is requested to provide customized research and development for the buyer, OFITE shall use its best efforts but makes no guarantees to the buyer that any products will be provided.

OFITE makes no other warranties or guarantees to the buyer, either express or implied, and the warranties provided in this clause shall be exclusive of any other warranties including ANY IMPLIED OR STATUTORY WARRANTIES OF FITNESS FOR PURPOSE, MERCHANTABILITY, AND OTHER STATUTORY REMEDIES WHICH ARE WAIVED.

This limited warranty does not cover any losses or damages that occur as a result of:

- Improper installation or maintenance of the products
- Misuse
- Neglect
- Adjustment by non-authorized sources
- Improper environment
- Excessive or inadequate heating or air conditioning or electrical power failures, surges, or other irregularities
- Equipment, products, or material not manufactured by OFITE
- Firmware or hardware that have been modified or altered by a third party
- Consumable parts (bearings, accessories, etc.)

Returns and Repairs:

Items being returned must be carefully packaged to prevent damage in shipment and insured against possible damage or loss. OFITE will not be responsible for equipment damaged due to insufficient packaging.

Any non-defective items returned to OFITE within ninety (90) days of invoice are subject to a 15% restocking fee. Items returned must be received by OFITE in original condition for it to be accepted. Reagents and special order items will not be accepted for return or refund.

OFITE employs experienced personnel to service and repair equipment manufactured by us, as well as other companies. To help expedite the repair process, please include a repair form with all equipment sent to OFITE for repair. Be sure to include your name, company name, phone number, email address, detailed description of work to be done, purchase order number, and a shipping address for returning the equipment. All repairs performed as "repair as needed" are subject to the ninety (90) day limited warranty. All "Certified Repairs" are subject to the twelve (12) month limited warranty.

Returns and potential warranty repairs require a Return Material Authorization (RMA) number. An RMA form is available from your sales or service representative.

Please ship all equipment (with the RMA number for returns or warranty repairs) to the following address:

OFI Testing Equipment, Inc.
Attn: Repair Department
11302 Steeplecrest Dr.
Houston, TX 77065
USA

OFITE also offers competitive service contracts for repairing and/or maintaining your lab equipment, including equipment from other manufacturers. For more information about our technical support and repair services, please contact techservice@ofite.com.